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CONTENTS

Ross—Arthropods in Texas Pocket-Gopher Burrows 57
The Chicago Natural History Museum 61
Knull—A Californian Acinopterus 62
As others see us 63
Chamberlin—Two new centipeds 64
Benesh—Esplanate versus Explanate 66
Whittaker & Stallings—Seasonal variation in Lepidoptera 67
Personal—Dr. Guy F. MacLeod 71
LaRivers—A summary of the Mormon Cricket 71
Mounting mosquito larvae 77
Entomological Literature 77
Exchanges 84

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ENTOMOLOGICAL NEWS

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Arthropod Collecting in the Burrows of a Texas Pocket-Gopher

By EDWARD S. ROSS, California Academy of Sciences

The writer's methods of collecting insects and other arthropods in pocket-gopher (*Geomys*) burrows and nests are here presented in the hope that they may be applied elsewhere by other workers. These investigations were prompted by the remarkable findings of Hubbell and Goff (1940) in Florida in burrows of *Geomys f. floridanus,* and the writer's desire to know more about the geographical distribution of some of the inquilines which they encountered. This work was conducted in the Carrizo Sands, seven and one-half miles southeast of Somerset, Texas (near San Antonio). The burrows at this locality were made by *Geomys breviceps attwateri* Merriam. Great assistance, for which the writer is very grateful, was given by Mr. A. J. Kirn, a local naturalist, and Dr. H. R. Roberts of the Academy of Natural Sciences of Philadelphia.

Two methods of collecting were employed—the molasses bait trap method and direct excavation. Of the two, the trap method yields the largest numbers of specimens with the least effort but direct excavation, which results in the discovery of the nest and a refuse chamber, is the most satisfactory method, as it provides data on the nature of the burrow system; complete populations of inquilines; and an opportunity to observe the ecological niche and role of each inhabitant.

The bait trap method used was the same as that described by Hubbell and Goff (1940) and consisted of first trapping the gopher with a spring trap and then inserting a half-pint jar, half filled with a molasses and water mixture (50–50), into the floor of a runway burrow. The excavation was then cov-

ered with a square of tin or cardboard which was banked with sand around the edges to exclude light and free living insects. Every day the insects trapped in the jar were removed, washed in water several times, and preserved in 70 per cent alcohol. Collections thus obtained were particularly rich in inhabitants of the subsurface runway system such as *Ceuthophilus* (camel crickets), *Rhadine* (Carabidae) and *Pseudoleria* (Diptera).

Direct excavation is very laborious and, as the subsurface runway system of one gopher burrow may extend several hundred feet, a great deal of luck is involved in contacting a tunnel which leads down to the nest. The element of chance can be somewhat lessened if the collector first surveys the arrangement of the mounds, or throw-out piles of sand, which indicate the course of the runways. The main objectives of such a survey should be: (1) to learn the extent of activity of one gopher and (2) to find the "central" point from which the subsurface runways seem to radiate. The nest should lie beneath such a "central" point.[1] It might also be suggested that the burrow chosen for excavation be one selected from the edge of the range of gopher activity, or one that is as isolated as possible. This will eliminate or reduce the difficulty of surveying the overlapping burrow systems of several gophers. A contact is made with one of the subsurface runways near the apparent "central" point and the burrow is followed. After much disappointment the collector may contact a runway that heads downward with an increased gradient. This may continue deeper and deeper for as much as twenty-five feet distance and three feet vertically. Suddenly the burrow may spiral for a short distance straight down.[2] At this time the excavation should be broadened so that the tunnel may be carefully excavated from the side so as to prevent a collapse of the nest chamber. At this stage some of the writer's excavations were about six feet square and four

[1] It will be noted in Hubbell and Goff's diagram (1940, fig. 1) of one of the two burrows they excavated, that the deepest point and fecal chamber, with a nearby spiral turn, is located near the intersection point of the three main runways.

[2] In the five nests excavated such a vertical spiral was encountered near or above every nest.

feet deep. After the spiral, the tunnel may continue for some distance downward (or at times upward) to the nest.

The nest chamber of the Texas gopher was usually about nine inches in diameter and filled with dry grass, roots, peanuts, and debris, such as old bones, apparently collected by the gopher. The nest material and the walls of the chamber literally teemed with arthropod life. It is best to immediately place the entire nest in a large, stout, paper bag which is then tightly twisted at the top. Then carefully excavate all the damp sand immediately surrounding the chamber (especially the floor) into another paper bag. This material may be carefully picked over for specimens upon return to the laboratory or placed in a Berlese funnel.

It will be noted that many steep burrows descend from several directions to the nest. Each of these should be followed for a short distance for stray inquilines and especially in a search for the gopher's "garbage pit" or fecal chamber, which is usually at a lower level than the nest chamber. It is in this "pit" filled with gopher feces, decomposing roots, etc., that the richest collecting is often encountered. It is here that the larvae and adults of the coprophagous Scarabaeidae, and other scavengers are found, together with larvae of their predators, such as the Histeridae. All this material should also be placed in a paper bag for careful examination in the laboratory and for rearing.

The writer's excavations were made in the winter of 1942–43 and it may be pointed out that it would be very difficult to excavate in this region at most other times of the year as the sand would be too dry and the heat too intense. In all, five nests (no two of which had the same kinds of populations and ratio of individuals) were uncovered and a large collection of arthropods was obtained, which it is hoped will be reported upon later in greater detail by specialists. Some of the species obtained have proved to be, and others yet may prove to be, new or "lost" species, the true habitats of which had not yet been discovered.

The writer urges entomologists to excavate animal burrows of all types in their particular area. The tedious labors are well rewarded by exciting and rare discoveries.

The following is a preliminary list of some of the arthropods collected:

Predominant Inhabitants of Nest Chamber

Acarina: *Macrocheles* sp. (Parasitidae), (very numerous), (dt. H. E. Ewing).
Araneida: Few pale Lycosidae.
Pseudoscorpionida: In two nests only (26 and 11 specimens).
Collembola: Numerous, especially Entomobryidae.
Orthoptera:
Ceuthophilus sp. (Gryllacrididae).
Coleoptera:
Rhadine myrmecoides Horn (Carabidae), (dt. E. C. Van Dyke).
Ptomaphagus sp. (Silphidae), (dt. E. S. Ross).
Atheta. Four species (Staphylinidae), (dt. E. S. Ross).
Onthophilus n. sp. (Histeridae), (dt. E. S. Ross).
Geomysaprinus goffi Ross (Histeridae), (dt. E. S. Ross).
Spilodiscus gloveri (Horn) (Histeridae), (dt. E. S. Ross).
Aphodius. Seven new species? (Scarabaeidae), (dt. O. L. Cartwright).
Asidopsis sp. Larvae (Tenebrionidae), (dt. R. A. St. George).
Hemiptera:
Blissus leucopterus Say [3] (Lygaeidae), (dt. R. I. Sailer).
Exptochiomera oblonga (Stål) (Lygeidae), (dt. R. I. Sailer).
Lepidoptera:
Amydra sp. Larvae feeding on nest (Tineidae), (dt. H. Capps).
Diptera:
Pseudoleria pectinata (Lw.) (Helomyzidae), (dt. M. T. James).
Maggots.

Predominant Inhabitants of Refuse Chamber

Acarina: see above.
Collembola: see above.
Coleoptera:
Ptomaphagus sp.
Atheta. Four species. Numerous larvae and adults.
Onthophilus n. sp. Fewer than in nest chamber.
Spilodiscus gloveri (Horn). Adults.
Larvae of Histeridae.
Aphodius. Numerous larvae, fewer adults.

[3] The presence of hibernating chinch bugs in the nests may have an economic significance. Rodent nests, because of their depth and the body warmth of the rodent, may contribute to the winter survival of such economic insects in their northern or marginal limits of range.

Tenebrionidae. One large larva.[4]
Diptera: Numerous maggots (*Pseudoleria*?).

Predominant Inhabitants of the subsurface runways

Ceuthophilus sp. and *Rhadine myrmecoides* Horn predominate; the latter, perhaps, prey on at least the early stages of the *Ceuthophilus* which in turn appear to feed upon the decomposing tubers and roots stored by the gopher in caches along the runway.

Pseudoleria pectinata Lw. is also abundant with scattered *Ptomphagus, Atheta, Aphodius* and *Geomysaprinus* which must wander up from the nest area.

REFERENCE

HUBBELL, T. H., AND C. C. GOFF. 1940. Florida pocket-gopher burrows and their arthropod inhabitants. *Proc. Florida Acad. Sci.*, IV (1939), pp. 127–166, 2 figs.

THE CHICAGO NATURAL HISTORY MUSEUM

The former Field Museum of Natural History has been recently granted an amended charter by the Secretary of State of Illinois, and is henceforth to be known as the Chicago Natural History Museum. As is well known, several important insect collections are housed in this museum, notably the collection of Lepidoptera of Hermann Strecker. Future references to these collections should use the new name of the institution.

According to an article in the January 14th issue of Science, the museum is continuing nearly normal activities during the war despite the absence of thirty-nine employees and trustees engaged in war services. Attendance the past year has been nearly normal; more than a million visitors were received. In entomology, Dr. Alfred E. Emerson, Dr. Charles H. Seevers and Mr. Alex K. Wyatt have recently been appointed research associates.

[4] The discovery of large Tenebrionidae larvae (Eleodini ?) as well as adults, in these, and other animal burrows the writer has excavated in arid regions, suggests that burrows, particularly of the open type made by spermophiles, may be the normal breeding places or refuges of such insects. The cool, moist depths of the tunnels offer the adults a means of escaping the rigors of the desert during the day and access to favorable places for oviposition.

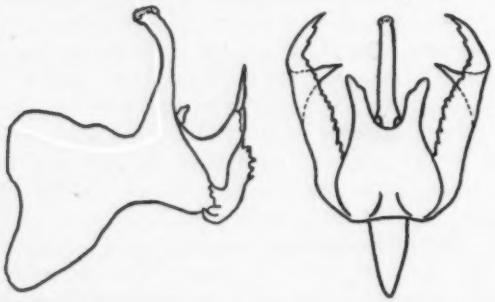
A Californian Acinopterus (Homoptera: Cicadellidae)

By Dorothy J. Knull, Ohio State University, Columbus, Ohio

Acinopterus morongoensis new species

Large, brown with light veins fuscous-margined, head and pronotum tinged with green; in form of inner male genitalia resembling *A. rostratus* Beamer and Lawson.[1] Vertex slightly narrower than pronotum, distinctly longer at middle than next eyes; elytra acute at apices.

Color. Buff above, green tinged on head, pronotum, scutellum and below, eyes reddish brown, pronotum darker posteriorly, lateral angles of scutellum slightly darkened, elytra with light veins distinctly and consistently brown-margined, cells of corium especially near cross-veins infuscate, also inner apices. In most specimens a distinct whitish bloom in posterior two-thirds of claval area; apex of last ventral segment of female embrowned medially, ovipositor reddish brown.



Ventral and lateral view of aedeagus of *A. morongoensis.*

Genitalia. Last ventral segment of female strongly produced, gradually narrowed on posterior two-thirds to width of

[1] Ann. Ent. Soc. Am., xxxi: 481, 1938. The Genus *Acinopterus.*

ovipositor where it is shallowly indented at apex, more than four times length of preceding abdominal segment. Male, aedeagus complex: in ventral view with outer pair of processes heavy, broadened on outer half, forming two large sharp points, serrate on inner edge, inner pair about half length of aedeagus, parallel to it and separated from it by about its width, notched near apex and projecting slightly laterad from notch; a minute tooth either side of aedeagus at base; shaft as long as outer processes, straight-sided, somewhat enlarged at apex; in lateral view outer processes apically produced in two sharp, widely separated points, aedeagus shaft bent dorsad on outer third, small basal tooth more prominent in this view.

Length: male 5¾–6 mm.; female 6–6½ mm.

Male holotype, allotype, one male and three female paratypes from Morongo Valley, CALIFORNIA, vi–19–42, D. J. and J. N. Knull Collectors, are deposited in the Collection of The Ohio State University.

AS OTHERS SEE US

Professor G. E. Hutchinson, of Yale University, regularly contributes a section on interesting current scientific papers to the journal published by Sigma Xi. In the January 1944 issue of the American Scientist (vol. 32, p. 78) he lauds the work of amateur astronomers and contrasts it with the work of amateur entomologists. We quote without comment:

"Both the study of butterflies and that of birds, with which we close these notes, have likewise benefited greatly by the labors of non-professional investigators. It is, however, probable that if amateur students of insect variation would take as much trouble to familiarize themselves with the elements of modern genetics and evolutionary theory, as the amateur astronomer devotes to the elementary methods of computations required in his science, the results would be even more significant than they are at present. A butterfly may have the answers to most of the problems of biology symbolically painted on its wings, but it is necessary to set these problems correctly before attempting to coax an answer from *Colias* or *Papilio*."

Two New Centipeds

By RALPH V. CHAMBERLIN, Salt Lake City, Utah

Of the two new centipeds here named and described the first was taken at quarantine in Honolulu from packing about a plant of *Epidendrum* sp. imported from Australia. The second was included with a "few odds and ends picked up in various strolls about the area" somewhere in New Guinea by James E. Hadley stationed there with a unit of the U. S. armed forces. The types for the present are retained in the author's collection.

Nipponobius australis new species

Antennae short; composed of 18 articles. Eyes consisting of four ocelli; thus, 1 + 2, 1. Of these ocelli the single ocellus and the bottom one of the group are smallest, the first of the top series largest. Prosternal teeth 2 + 2, small and pale. Coxal pores small, circular. None of posterior coxae armed. Ventral spines of penult legs, 0, 1, 2, 1, 0; dorsal, 0, 0, 2, 0, 0; claws 2. Anal legs missing from type. Gonopods of ♀ with claw tripartite, basal spines 2 + 2.

Length, 4.75 mm.

Holotype: A female taken at HONOLULU, Apr. 22, 1943 in packing about *Epidendrum* sp. from AUSTRALIA.

This species differs from the three previously known in having the articles of the antennae 18 instead of 20. From *migrans* and *sinensis* it differs also in the fewer ocelli and the spining of the penult legs. From *N. annectus* it differs in the tripartite claw of the female gonopods, as well as in the spining of the legs. *N. australis* is the smallest of the four species now referred to the genus.

Genus **Gomphor**, new genus

A genus of Scutigeridae in which the antennae have most articles much broader than long. Legs from fifth pair on with

spines at end of the first tarsal division. On the second tarsus of anterior legs pegs of uniform size present in a continuous series, peg-bearing articles not alternating with pegless ones as in *Scutigera.* Tergites bearing short spines over margins and surface, each of which has at its base normally a sense hair much as in *Theruonema;* very fine, short hair points in spaces between spines.

Genotype.—Gomphor hadleyi, new species

Apparently nearly related to *Scutigera* from which it is most readily separated by the difference in arrangement of the tarsal pegs.

Gomphor hadleyi new species

Sides of dorsum dark olive brown with a continuous median dorsal stripe bluish white. The median stripe expands on the head to cover most of the width and caudally expands to embrace all, or all but 7 narrow lateral borders, of the eighth tergite and the following segments. Legs marked with bluish while annult between which the color is dark, more or less olive.

Articles of antennae very short in comparison with length. Articles of antenna I 44; of antenna II, about 52.

First division of tarsus of leg II with 9 articles, the second division with 22, of which the first 5 and the last one are longer, the intervening short ones bearing uniform tarsal pegs; no spines at end of first tarsus. First division of tarsus III with 8 articles, the second with 22; no spines at end of first division, the second with pegs as in leg II. First division of tarsus of leg IV with 9 articles, the second with 19; no terminal spine. First tarsal division of leg V composed of 6 articles, the second of 19; first tarsus with a spine at end. First tarsal division of leg VI composed of 5 articles of which the first has become proportionately very long. The second of 18; first tarsus with terminal spines of which one is much reduced. First tarsus of leg VII consisting of 5 articles, the second of 18; first tarsus ending in two spines. First tarsus of leg VIII consisting of 6 articles, the second of 19; first tarsus with 2 terminal spines.

First tarsus of leg IX of 5 articles, the second of 20; first tarsus ending in 2 spines.

Syntelopodite of female gonopods nearly parallel-sided, the width across its caudal end but slightly exceeding that across cephalic; space enclosed by terminal pieces very narrowly elliptic.

Length, about 9 mm.

Holotype: One female picked up "somewhere in NEW GUINEA" in Sept. 1943, by James E. Hadley.

Esplanate versus Explanate

In my recent paper [1] a substitution by the editors of a letter puts an entirely different meaning on the characters described; the used word esplanate, was altered to explanate, an "Ersatz" wholly unsuitable. The following, I hope, will illustrate the point in question:

ESPLANATE.—The late Col. Casey used several military terms in his entomological works, one of these being esplanate, derived from esplanade, which is defined in military parlance as "any clear, level space especially suited for military displays or maneuvering of troops." I am using the word in the same sense as Col. Casey.

EXPLANATE.—According to Webster, explanate is "spreading out or extending outwardly in a flat form," i.e., projecting outward, as used by Smith,[2] who defines it "spread out and flattened; applied *to a margin.*" *

It is needless to say that the substitute does not fit the conditions, as in one instance dorsal aspect (p. 43, line 30) is described, the other being abdominal segments (p. 47, line 14); there is no allusion nor reference *to a margin.*

BERNARD BENESH, North Chicago, Illinois

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[1] Psyche, 50: 37–49, 1943.
[2] Smith, John B., Explanation of Terms used in Entomology, p. 48, 1906.
* The italics are mine.

Notes on Seasonal Variation in Lepidoptera

By Robert Whittaker and Don B. Stallings,
Eureka and Caldwell, Kansas

Genus Eurema (Hübner)

The genus *Eurema* has been one of the more confused in the Americas. The key to the difficulty is the failure to recognize that most (if not all) species of this genus show distinct seasonal variation. Thus many forms, particularly seasonal ones, have been named as races or even as species. A simple example is to be found in *Eurema proterpia* (Fabr.) and *Eurema gundlachia* (Poey). Bates suggested that *gundlachia* might be a form of *proterpia.* In this he is correct as it is the winter form of *proterpia.* This is no isolated example. Comparison of many so-called species and races with winter forms that we have studied in material from North America shows that the same problem runs through the entire genus.

Most of the confusion apparently has arisen when a collector who may have taken a series of the extreme summer form in one location, a series of the extreme winter form in a second location and a series of intermediates in a third location has regarded them as three races, or even as three distinct species and named them as such. The Mexican material in the Stallings-Turner Collection clearly indicates that no student is justified in naming a species or race without collecting a full series of specimens throughout the year showing the seasonal variation in all of the localities involved. Seasonal variation is almost universal in Mexican material and unless extreme care is taken seasonal forms will be described as species and races.

In this paper we shall deal with the northern species of *Eurema,* being a part of those that are recorded as occurring in the United States. Careful study of the more southern material will undoubtedly reveal further seasonal forms named as species and races.

The seasonal variation in *Eurema* shows two tendencies. In one group of species the lower secondaries tend to be suffused with reddish in the winter form. This group might well be referred to as the Rosa Group and includes such species as *daira, nicippe, boisduvaliana, mexicana* and *proterpia.* In the other group the lower secondaries tend to have increased maculation in the winter form. This group might well be referred to as the Maculata Group and includes such species as *lisa, nise* and *dina.* It may also be noted that in those species that have tails the winter form has the tails longer and more pointed. This last character is not limited to the genus *Eurema* by any means as a good many species that show seasonal variation show a change in wing shape, particularly in tails and apices. The genus *Anaea* (Hübner) is a very good example.

The winter form of *Eurema mexicana* (Boisduval) will be taken as typical of the Rosa Group. For convenience in studying this, we have arbitrarily classified this species into five phases from the extreme summer form to the extreme winter form. These phases do not necessarily represent different broods. These phases are as follows:

1. Male. Black margin on upper secondaries extends down to tail. Lower secondaries solidly yellow with very light or no maculation. Submesial bar of lower secondaries faintly traced. Tails short and blunt.

   Female. Similar to phase two male. Black margin on upper secondaries ends in vicinity of vein M_2.

2. Male. Black margin on upper secondaries not as broad as in phase one and does not quite reach the tail. Submesial bar on lower secondaries apparent and brown in color. Inner marginal spot distinct with some maculation present on lower secondaries. Tails short but not so blunt.

   Female. Similar to phase three male. Black margin as above noted.

3. Male. Black margin on upper secondaries ends in vicinity of vein M_2. Red coloring apparent at apex of lower primaries. Transverse striations on lower secondaries appear, but are not predominant. Tails short but pointed.

   Female. Similar to phase four male. Black margin of secondaries, above, limited to upper veins being marked in black.

4. Male. Black margin on upper secondaries as in phase three. Transverse striations on lower secondaries predominant, but not sufficiently so as to give the wings an over-all pinkish appearance. Tails are long and pointed.

   Female. Similar to phase five male. Black margin of secondaries limited to upper veins being marked in black.

5. Male. Black margin on upper secondaries as in phase three. Transverse striations on lower secondaries predominant, and giving lower secondaries an over-all pinkish appearance or completely covering the yellow ground color. Tails long and pointed. Apex of forewing more square than in phase one.

   Female. Similar to male. Black margin on upper secondaries sometimes entirely lacking. Pinkish striations in turn suffused with a chalky coloring.

These arbitrary phases may be applied to other genera as well. For example it becomes apparent at once that *Zerene caesonia* f. *rosa* (McNeill) and *rosea* (Rober) are merely two phases of the winter form.

The Maculata Group may be divided in a similar fashion. The extreme summer form is nearly immaculate while the extreme winter form has the lower secondaries heavily suffused with brownish specks and with increased maculation.

Dr. A. B. Klots in his revision of the genus in 1929 points the way to the solution of one of the most vexing problems in

this genus. He points out that *daira, jucunda* and *palmyra* (and *nigrocincta,* not herein considered) may be but a single species. In the northern range of this species, *jucunda* and *daira* have long been accepted as separate species, although the lack of genitalic variation and the anology to the seasonal forms above described by phases leaves little doubt but that *daira* and *jucunda* are only the winter and summer forms of the same species. *Palmyra* has in turn been divided into two races, *palmyra* representing the race in the islands of the West Indies and *lydia* representing the mainland race. In the Stallings-Turner Collection a series of *jucunda* and *lydia* collected in Mexico from Laredo to Vera Cruz shows that these two intergrade into each other. Thus the replacement of the yellow of the upper secondaries with white as in *palmyra* and *lydia* is at most a racial tendency corresponding with the more southern latitudes. A study of a small series of the form *sidonia* indicates that it is an altitude form. *E. eugenia* often considered as a race of *daira* is in reality the winter form of *lydia.* The race of *Eurema proterpia watsonia* (Klots) described from Ecuador has the same characters as phase one of *Eurema proterpia* (Fabr.) caught at Victoria, Mexico.

It is not unusual to find a few specimens of the winter form flying in the spring and especially is this true when the previous fall has been short and cold.

At times a winter form will be caught flying with the summer form or vice versa, due no doubt to the peculiar place where this particular individual pupated. Normally the summer form is replaced by the winter form in a matter of a few days. One day the normal summer form is in full flight, then there will be a weather change, during which time little material is in flight, and two or three days later the winter form is in full flight with few or no summer forms flying. We have a series of *jucunda* caught at Savannah, Ga., up to and including Sept. 14, 1937, and a series of *daira* caught from Sept. 16 on.

Phase three of most of these species is rare and difficult to secure.

Small series of both *Eurema dina westwoodi* and *nise perimede* in the Stallings-Turner Collection indicate that they are subject to similar seasonal variation; the series available, however, is too small to describe the unnamed forms.

Field described a female form of *Eurema nicippe* under the name of *callae*. We have not been able to examine the type but from the description are of the opinion that this is a phase five, or extreme winter form and hence a synonym of *nicippe*. We suggest that form *clappi* (Maynard) of *Eurema lisa* is likewise a phase five, or extreme winter form and hence a synonym of *lisa*.

(*To be continued*)

PERSONAL

Dr. Guy F. MacLeod, professor of entomology at the University of California, has been appointed chief of the chemicals and fertilizer branch of the Chemical Division of the War Food Administration.

A Summary of the Mormon Cricket (Anabrus simplex) (Tettigoniidae: Orthoptera)

By Ira La Rivers, Bremerton, Washington

A considerable fund of information concerning the biologics and economics of the Mormon cricket (*Anabrus simplex* Haldeman) has accumulated in recent years in widely-scattered journals throughout the country, and I have thought it expedient to review the essential features of the more important of these papers for the sake of unification and clarity, as well as to add certain hitherto unpublished aspects of the problem.

The 1848 "cricket war" in the Great Salt Lake valley was the first record of this species' destructive capabilities, and it has periodically appeared in many surrounding states since then. The total distribution of the species embraces nearly all the western United States, viz., Washington, Oregon, California, Idaho, Nevada, Montana, Wyoming, Utah, Colorado, New

Mexico, North and South Dakota, Nebraska, Kansas, Minnesota and adjacent Canada. It is not, fortunately, of economic importance over the entire area of its occurrence, but in 1939, ten states had found it of sufficient importance to attempt control measures, with the aid of the Federal Government.

While there have been many infestations of local importance, the major outbreaks have occurred in Utah (Great Salt Lake valley, 1848–1850; Duchesne and Uinta Counties, 1923–1926), Idaho (various districts in southern Idaho, 1872, 1883, 1894, 1904, and 1932–1940), Nevada (Tuscarora, Elko County, 1878; Pine Valley, Eureka County, 1882; Diamond Valley, Eureka County, 1886; Cortez area, Lander County, 1900–1904; Elko, Humboldt, Eureka, Lander, and Pershing Counties, 1932–1940), Colorado (northwestern section, 1879, 1882, 1895, 1900, 1902, 1905, 1924–1928, and 1928–1931), Wyoming (Hot Springs County, 1923–1925; various districts in the state, except the southwest sector, 1932–1938), Montana (Carbon County, 1923; Lake and Sanders Counties, 1924–1928; southeastern section, 1932–1940), North Dakota (southern portion, 1932–1940), South Dakota (central portion, 1932–1940). Cooperative Federal, State, and County efforts must be exercised in any satisfactory system of control. At the present time, the species is pandemic over a wider area than at any other time in its recorded history.

Present-day control methods are reasonably satisfactory when the infested country is such that modern, efficient machinery can be used, as power dusters and airplanes. Rough, rocky terrain requires the use of slower, less comprehensive hand dusters with a consequent loss of killing power. Districts with well-ditched sections advantageously situated for the use of oiling further increase the efficiency of known control methods. Level or rolling country in which crickets are moving as bands is suited to the erection of tin barriers to reflect the marching insects into traps of various types where they may be dusted, burned, or merely left in the hot sun, which quickly kills them.

The first efficacious dusting mixtures were developed by Shotwell and Cowan for use in Montana field work (1926) and

consisted of one part sodium arsenite to four parts hydrated lime, and one part calcium arsenite to three parts lime, with a recommended application of five-to-seven pounds per acre for the former and eight pounds for the latter, depending upon cricket concentration. The latter compound has been largely discarded in favor of the more toxic sodium arsenite, and cheaper diatomaceous earth has been substituted for lime, which is irritating to human skin. It is a relatively simple matter to mix the ingredients, which are then delivered with power and hand dusters; assuming the topography of the country to be suitable for power duster use, hand dusters are still valuable supplements especially for spraying early morning concentrations of crickets where they have spent the night clustered under, and in, sagebrush (*Artemisia tridentata*), etc., and along rough coulee and cañon bottoms.

Successful oil barriers require irrigating ditches, canals, or streams upon which the oil can be spread, and are an excellent control method under these conditions. A thin, low-grade distillate has been found most satisfactory, since it flows freely, spreads rapidly and smoothly, and forms a uniform, thin film. Just enough need be used to form the thinnest film on the water's surface, and when used correctly, neither disqualifies the water for human consumption nor for irrigation purposes. Oil can be retained in the main ditch by baffle boards or underwater delivery boards, which prevent it from entering secondary ditches; when present in moderate excess, however, it does no harm to plants or livestock, merely acting as a laxative to the latter. It kills crickets by enclosing them in an oil film through which they cannot breathe.

Metal barriers most successfully used are ten- and twelve-inch strips of 28-gauge galvanized sheet iron in 50- or 100-foot rolls. These are erected across the crickets' line-of-march, care being taken to clear the ground before the barrier so the brush does not overlap, and to keep the supporting pegs well below the level of the barrier so these cannot serve as ladders for the animals to climb over. Traps of various types must be utilized with metal barriers, and may be pits in the ground, or traps formed

by making large corrals of the galvanized sheeting out of which crickets cannot climb.

Baiting has proven as unsatisfactory with crickets as it has been successful with grasshoppers.

Those first interested in the biologics of the Mormon cricket were undoubtedly the American Indian (Amerind) tribes who used the insect for food. From reports of early pioneers, these included principally those tribes of Shoshoni origin and probably all Ute tribes of southern and eastern Utah and adjacent parts of Colorado, as well as the Bannocks of southern Idaho. The Northern Piutes bordering the Shoshonis on the west and occupying western Nevada, southeastern Oregon and portions of southwestern Idaho likewise feasted on insects on occasion, but the Southern Piutes were too far south to have come in contact regularly with epidemic cricket bands. Crows, Flatheads, and Nez Perce, although occupying areas of large cricket populations, evidently did not exist in the extreme poverty which usually characterized Amerinds of the Great Basin area generally, so probably did not require such items as insects in their diets. Early Mormon accounts of the use of the cricket as food by local natives (probably Weber Utes) tell of the Amerinds seining the insects from streams with baskets especially constructed for such work, sun-drying and roasting them for future consumption (Hendson 1931). In a region where many of the tribal groups were forced to subsist on lizards, roots, pinenuts, etc., the appearance of thousands or millions of large crickets must have been regarded by them with satisfaction, although most readers of this would face the prospect of such a meal with extreme repugnance.

The Mormons of 1848 were the first whites with reason to be interested in the large black crickets, and made many impromptu observations on the species' life history. In 1850, Captain Howard Stansbury led a United States Government expedition to explore the valley of the Great Salt Lake and to collect such biologic items, at the request of S. F. Baird, Smithsonian Institute secretary, as the party could while conducting their survey. Among the specimens returned to Washington was one largely

legless, adult tettigoniid which Prof. Haldeman described as *Anabrus simplex* because of its unprepossessing appearance. Haldeman said of it in the report of the expedition published in 1853: "A single specimen was brought from the Valley of the Great Salt Lake. . . . This seems to be one of the species eaten by the aborigines of the Valley. . . ." No mention was made of the species as a destructive agent, and it is clear that neither Haldeman nor Baird suspected this wingless cricket to be the "plague" insect of 1848, for in describing a new oedipodine from the same region (*Oedipoda corallipes*), Haldeman said: "This fine large grasshopper is probably the species which has been destructive to vegetation in the Valley of the Great Salt Lake" and Baird clearly indicated beyond doubt that he shared the misconception by the introductory statement that "The principal entomological result" (of the expedition) "is the precise determination of the destructive grasshopper, which, but for the interposition of a species of tern, at one period was near turning the 'Garden of the mountains' into a desert." It is not printed, to the author's knowledge, when the true status of *Anabrus simplex* became established. It is certain the error was corrected soon afterward.

In 1931 Henderson, assuming the inviolability of the common name, in discussing the original error stated "For Baird to be correct about having the right species in mind it must be clear that he should have said 'cricket' instead of 'grasshopper.'" On this basis alone, it would not be entirely safe to evaluate such a statement by an elder naturalist since entomologists in general have not, in the printed word, made quite the distinction between crickets and grasshoppers as Henderson has the logic to make; in fact, the majority of publications including the tettigoniids usually call them crickets and apologize immediately in parentheses or a footnote that they are, after all, "long-horned grasshoppers instead," to differentiate them from the Locustidae, or short-horned grasshoppers. As may easily be verified by a study of the groups involved, the Tettigoniidae are more closely allied to true crickets than to grasshoppers, and it is begging

the question to call them "long-horned grasshoppers." In this case, the use of the common name shows better judgment.

Gradually more information accumulated, but organized official action was not taken in the matter of control until the turn of the 20th century; in 1902 the University of Nevada Agricultural Experiment Station undertook preliminary field work in northeastern Nevada in an effort to control an outbreak in Starr Valley, but little constructive information accrued from this work (Doten 1904). Similar work was carried on, about the same time, by the Idaho (Aldrich 1904) and Colorado (Gillette and Johnson 1905) Experiment Stations. Desultory official recognition persisted until the early 1920's, when Colorado state entomologists began contributory work on life history and control, publishing three bulletins on the results of their research between 1920 and 1930. Progress followed rapidly, culminating in Cowan's admirable investigations in Montana in 1926 and 1927 (Cowan 1929) in which, for the first time, the essentials of the animal's life history and satisfactory control measures were worked out and successfully applied in the field. During the 1930's, several state and Federal bulletins were published on the economics of the cricket, each contributing a little more to the growing fund of knowledge.

Interest was turning to the less immediately applicable economic aspects of the problem, such as the possibilities presented by biological control. Isolated observations on certain elements of this complex had been made and published from time-to-time in economic bulletins. Cowan's bulletin (1929) was the first to bring together any significant amount of this type of information in detail, and gave the first preliminary account of the most important of the crickets' parasites and predators. He gave a preliminary list of the birds which fed on the cricket, listing 19 forms representing ten families. This was a summation of what had accumulated up to that time. In 1939, the number of birds known to feed on the animal was raised to 37, distributed among eighteen families (La Rivers 1941). In addition, Cowan mentioned some common mammals in passing, and a section was devoted to the principal parasites. At that

time it was known that the crickets' eggs were attacked by a tiny scelionid wasp *Sparaison pilosum* Ashmead, which had been seen to so reduce the yield of several western Montana cricket eggbeds that no control was necessary the following season. Then, as now, this wasp was considered potentially the most important of the crickets' parasites, but to date (1943) no further detailed knowledge of the possibilities presented by this phase of the problem has accrued.

A more conspicuous parasite of the cricket is the much larger black cricket wasp, *Chlorion laeviventris* (Cresson), which has a less noticeable effect in reducing the crickets' numbers, but which, nevertheless, is a factor. The details of this species' parasitization were only generally outlined by Cowan, since uncorrelated field observations formed the only basis for the known facts.

(*To be continued*)

Mounting Mosquito Larvae

In the issue of *Science* for March 10, 1944, Captain W. W. Middlekauff described a method of preparing slides of mosquito larvae by dehydrating in ethyl alcohol, clearing in creosote and then mounting in Canada Balsam. The method is not entirely new but is excellent for rapidity, ease and permanence.

Current Entomological Literature

COMPILED BY THE EDITORIAL STAFF.

Under the above head it is intended to note papers received at the Academy of Natural Sciences of Philadelphia and the University of Pennsylvania, pertaining to the Entomology of the Americas (North and South), including Arachnida and Myriopoda. Articles irrelevant to American entomology will not be noted; but contributions to anatomy, physiology and embryology of insects, however, whether relating to American or exotic species will be recorded.

This list gives references of the current or preceding year unless otherwise noted. Continued papers, with few exceptions, are recorded only at their first installment.

For records of Economic Literature, see the Experiment Station Record, Office of Experiment Stations, Washington. Also Review of Applied Entomology, Series A, London. For records of papers on Medical Entomology, see Review of Applied Entomology, Series B.

NOTE: The figures within brackets [ ] refer to the journal in which the paper appeared, as numbered in the List of Journals given at the end of the literature. The number of the volume, and in some cases, the part, heft, &c. is followed by a colon (:). References to papers containing new forms or names not so stated in titles are followed by (*); if containing keys are followed by (k); papers pertaining exclusively to Neotropical species, and not so indicated in the title, have the symbol (S).

Papers published in ENTOMOLOGICAL NEWS are not listed.

GENERAL.—Felt, Ephraim Porter, 1868–1943.—(Obituary) [68] 99: 52–53. **Fox, W. B.**—Some insects infesting the "selenium indicator" vetches in Saskatchewan. [4] 75: 206–07. **Fraenkel & Blewett.**—The natural foods and the food requirements of several sps. of stored products insects. [36] 93: 457–90. **Mosley, M. E.**—The preparation of insects for the microscope, with special reference to Trichoptera. [9] 76: 241–51. **von Muttkowski, Richard Anthony,** 1887–1943.—(Obituary) [Trans. Amer. Micr. Soc.] 62: 425. **Packard, C. M.**—Insect enemies of our cereal crops. [Smiths. Rept.] 1942: 323–38, ill. **Poulton, Edward.**—Obituary by G. D. Hale-Carpenter. [31] 153: 15–17. **Tait &c.**—The sale of the Tait, Whitehouse and other collections. [9] 76: 254–56. **Cortés, R.**—A glance at Chilean entomology. [10] 45: 226–32. **Anon.**—The importance of entomology in war times. [118] 17: 46–48. **Ball, Elmer Darwin,** 1870–1943.—(Obituary by Osborn. Graf & Poos.) [10] 46: 20–22, photo. **Blackman, Maulsby Willett,** 1876–1943.—(Obituary, with bibliography by Craighead, Stage & Buchanan.) [10] 46: 14–21, photo. **Bondar, G.**—Insectos nocivos e molestias do coqueiro (cocos nucifera) no Brasil. [Bol. Inst. Cent. Formen. Econ. Bahia] no. 8: 160 pp., ill.

ANATOMY, PHYSIOLOGY, MEDICAL.—Butt, F. H.—Comparative study of mouthparts of representative Hemiptera-Homoptera. [Cornell Univ., Agr. Exp. Sta.] Memoir 254: 1–28, ill. **Butler, Jeffree & Kalmus.**—The behavior of a population of honeybees on an artificial and on a natural crop. [33] 20: 65–73. **Eastham & McCully.**—The oviposition responses of Calandra granaria. [33] 20: 35–42. **Fraenkel & Blewett.**—The basic food requirements of several insects. [33] 20: 28–34. **Ho, Shen, Tang & Yü.**—Physiology of the silkworm. II. Mechanism of silk formation as revealed by x-ray analysis of the contents of the silk gland in Bombyx mori. [23] 17: 78–82. **Hsueh & Tang.**—Physiology of the silkworm. I. Growth and respiration of Bombyx mori during its entire life cycle. [23] 17: 71–77. **Hughes, T. E.**—The respiration of Tyroglyphus farinae. [33] 20: 1–5. **Hungate, R. E.**—Quantitative analyses on the cellulose fermentation by termite protozoa. [7] 36: 730–739, ill. **Lees, A. D.**—On the behavior of wireworms of the gen. Agriotes. I. Reactions to humidity. [33] 20: 43–53. II. Reactions to moisture. Ib. 54–60. **Shull,**

A. F.—Inheritance in lady beetles. I. The spotless and spotted elytra of Hippodamia sinuata. [Jour. Heredity] 34: 329–37, ill. **Walker, E. M.**—On the anatomy of Gryll-oblatta campodeiformis Walker. 4. Exoskeleton and musculature of the abdomen. [7] 36: 681–706, ill. **Watson, M.**—The geographical aspects of malaria. [Smiths. Rept.] 1942: 339–50.

ARACHNIDA AND MYRIOPODA—Chickering, A. M.—Twenty-one n.sps. of Dipoena (Theridiid) from Panama. [Trans. Amer. Micr. Soc.] 62: 329–81, ill. **Goodnight, C. J. & M. L.**—More Phalangida from Mexico. [40] no. 1249, 13 pp., ill. (*). **Marshall, R.**—Hydracarina from California. Part II. [Trans. Amer. Micr. Soc.] 62: 404–15, ill. (*). **de Mello-Leitao, C.**—Araneologica varia Brasiliana. [15] 15: 255–65. **Newell, I. M.**—A new sironid from N. America (Opiliones). [Trans. Amer. Micr. Soc.] 62: 416–22, ill. **Stahnke, H. L.**—Scorpions of the U. S. [Turtox News, Chicago] 22: 20–22, ill.

SMALLER ORDERS AND ORTHOPTERA—Cable, R. M.—The indian rat flea, Xeropsylla cheopis, in Indiana. [Proc. Indiana Acad. Sci.] 52: 201–202. **Callan, E. McC.**—Natural enemies of the cacao thrips. [22] 34: 313–21. **da Costa Lima, A.**—Insectos do Brasil. IV. Panorpatos, Suctorios, Neuropteros, Trichopteros. 141 pp., ill. **Crawford, J. C.**—A new gen. and sp. of Hoplothripini (Thysanoptera). [10] 45: 221–25, ill. **Fraser, F. C.**—Notes on the gen. Agriogomphus and Ischnogomphus with the descr. of the male of Agricogomphus sylvicola. [108] 12: 161–66, ill. **Frison, T. H.**—Three n.sps. of Capnia from Colorado (Plecopt). [1] 69: 151–57, ill. **Joyca & Eddy.**—A list of fleas (Siphonaptera) collected at Tama, Iowa. [81] 18: 209–15. **Kevan, D. K. McE.**—An account of Schistocerca flavofasciata in Trinidad. [22] 34: 291–310, ill. **Milne, D. J.**—The distribution and life histories of the caddice flies of Waskesiu Lake, Saskatchewan. [4] 75: 191–98. **Morison, G. D.**—Notes on Thysanoptera found on flax (Linum usitatissimum) in the British Isles. [20] 30: 251–59. **Mosely, M. E.**—(See under General.) **Volkonsky, M. L.**—Rearing locusts in captivity. [22] 34: 253–56.

HEMIPTERA—Butt, F. H.—Comparative study on mouthparts of representative Hemiptera-Homoptera. [Mem. Cornell Univ.] 254: 20 pp., ill. **Davidson & DeLong.** Studies of the genus Empoasca. Part II. Six n.sp. from

Mexico. [7] 36: 636–640, ill. **DeLong, D. M.**—A n.gen Artucephalus, and a n.sp. of Mexican leafhopper. [7] 36: 654–655, ill. **Ferris, G. F.**—The gen. Targionia and some of its allies (Coccid: Diaspid). [117] 8:82–111, ill. **Harris, H. M.**—A new Harmostes, with a provisional key and a check list to the sps. (Corizidae). [81] 18: 191–98, ill. **Harris, & Shull.**—A preliminary list of Hemiptera of Idaho. [81] 18: 199–208. **Knight, H. H.**—New sps. of Polymerus from the U. S. (Mirid.). [4] 75: 179–82. **Russell, L. M.**—A toxonomic study of the genus Aleuroglandulus bondar (Aleyrodid). [10] 46: 1–9, ill. (k*). **Usinger, R. L.**—A revised classification of the Reduvioidea with a new subfamily from South America. [7] 36: 602–618, ill (*k).

LEPIDOPTERA—Atwood, C. E.—The third tent caterpillar in eastern Canada (Lasiocampid). [4] 75: 203–05, ill. **Bird, J. F.**—Apparent sex disparity in Lepid. [9] 76: 260–61. **Brown & MacKay.**—The jack pine budworm and the spruce budworm, Cacoecia fumiferana (Tortricid). [4] 75: 207–11, ill. **Clench, H. K.**—Two n. subsps. of Incisalia (Lycaenid). [4] 75: 182–85. **Forbes, W. T. M.**—The genus Thyridia. [7] 36: 707–716, ill. (*kS). **Freeman, H. A.**—Leodea tyrtaeus, new to the U. S. (Hesperid). [Field & Laboratory, Lancaster, Tex.] 9: 45. **McDunnough, J.**—Notes and descrip. of N. American Geometridae. [4] 75: 211–18 (*). **McGuffin, W. C.**—New descri. of larvae of forest insects, VII, Pero, Nepytia, Caripeta (Geometrid). [4] 75: 186–90, ill. **Michelbacher & Smith.**—Some natural factors limiting the abundance of the alfalfa butterfly. [Hilgardia, Calif.] 15: 369–97, ill. **Russell, S. G. C.**—Mice eating butterflies. [21] 55: 122–23. **Shepard, H. H.**—The types of Hesperioid genera. Further additions and corrections to the Lindsey list, 1925. [7] 36: 754–760. **Wishart, G.**—Note on the establishment in Canada of imported parasites of the peamoth. Laspeyresia nigricana. [4] 75: 237–38.

DIPTERA—Alexander, C. P.—New or little known Tipulidae. LXVIII. Neotropical sps. [75] (11), 10: 738–65. **Brooks, A. R.**—A review of the N. Amer. sps. of Gonia sens. lat. (Tachinid). [4] 75: 219–36, ill. (k*). **Burdick, W. N.**—Notes on Heteropogon vespoides and other Asilidae. [4] 75: 199–202 (*). **Fairchild, G.**—Life story of the mosquito. [Nat. Geogr. Mag.] 85: 180–96, col. ill. **Hall, J. A.**—Notes on the dogwood fruit fly, a race of

Rhagoletis pomonella. [4] 75: 202. **Hull, F. M.**—Three n.sps. of syrphid flies in the British Museum of Nat. Hist. [10] 46: 10–12 (S). **Johannsen, O. A.**—Two n.sps. of American Ceratopogonidae. [7] 36: 761–762. A generic synopsis of the Ceratopogonidae of the Americas, a bibliography and a list of the North American species. [7] 36: 763–791, ill. (k). **Jones, J. W.**—Observations and suggestions concerning some factors related to malaria mosquito surveys. [Jour. Tenn. Acad. Sci.] 18: 298–304. **Judd, W. W.**—Dipterous larvae parasitic on nestlings of the song sparrow. [Canada. Field. Nat.] 57: 146.. **Rau, P.**—Some robber flies and their prey. [4] 75: 205. **Stage, H. H.**—Saboteur mosquitoes. [Nat. Geogr. Mag.] 85: 165–70, ill. **Watson,M.**—(See under Anatomy.)

COLEOPTERA—Balfour-Browne, J.—A n. generic name in the Dytiscidae. [108] 21: 172. **Beerbower, F. V.**—Life history of Scirtes orbiculatus Fabius. [7] 36: 672–680, ill. **Blake, D. H.**—The generic position of Hypolampsis pilosa and some related n.sps. (Halictid). [10] 45: 207–21, ill. (k). **Eastham & McCully.**—(See under Anatomy &c.) **Henderson, F. Y.**—The depletion of starch from the sapwood of the ash (Fraxinus excelsior) and its relation to attack by powder-post beetles (Lyctus spp.). [20] 30: 201–208. **Jordan, K.**—A case of progressive evolution in Coleoptera which, if uncontrolled, would lead to extinction. [107] 18: 99–105, ill. **La Rivers, I.**—A list of the Eleodes of Nevada, with the descr. of a n. subsp. Tenebrionid). [13] 35: 53–61, ill. **Lees, A. D.**—(See under Anatomy &c.) **Linsley & MacSwain.**—Observations on the life history of Trichodes ornatus, a larval predator in the nests of bees and wasps. [7] 36: 589–601, ill. **Wenzel, R. L.**—On the classification of the histerid beetles. [Field Mus. N. H., Zool. Ser.] 28: 51–151, ill. (*).

HYMENOPTERA—Bequaert, J. C.—On the so-called Mischocyttarus ater, polybia, atra and their relatives. [7] 36: 717–729, ill. (*Sk). **Butler, Jeffree & Kalmus.**—(See under Anatomy &c.) **da Costa Lima, A.**—Segunda contribuicao ao conhecimento da biologia do Telenomus polymorphus n.sp. (Scelion). [15] 15: 211–27, ill. **Donisthorpe, H.**—A list of the type sps. of the gen. and subgen. of the Formicidae. [75] (11), 10: 721–37. **Doubleday, B. S.**—A brief introduction to the study of chalcids. [60] 1942–43, (2): 56–66. (Key to fam.) **Ford, R. L. E.**—On collecting and rearing parasitic Hym. with special

reference to the gen. Apanteles (Braconid). [107] 18: 89–94. **Headley, A. E.**—Population studies of two sps. of ants, Leptothorax longispinosus and curvispinosus. [7] 36: 743–53. **Mitchell, T. B.**—On the classification of neotropical Megachile. [7] 36: 656–71, ill. (*k). **Morris, R. L.**—An annotated list of the ants of Indiana. [Proc. Indiana Acad. Sci.] 52: 203–24. **Osburn, R. C.**—Two unusual Vespula nests. [7] 36: 740–42. **Parker, H. L.**—Gross anatomy of the larval of the wasp Polistes gallicus. [7] 36: 619–24, ill **Rau, P.**—Notes on the nesting habits of certain social and solitary bees of Mexico. [7] 36: 641–46, ill. The nesting habits of certain sphecid wasps of Mexico, with notes on their parasites. [7] 36: 647–53, ill. **Schell, S. C.**—The biology of Hadronotus ajax Girault, a parasite in the eggs of the squash bug. [7] 36: 625–35, ill.

SPECIAL—Opinions and declarations rendered by the International Commission on Zoological Nomenclature: Declaration 1, Code of ethics to be observed in the renaming of homonyms; 2, On the importance of avoiding the issue of author's reprints or separata in advance of the publication of the work or journal in which the paper in question is to be published; 3, On the importance of giving a clear indication of the date of issue of every zoological publication; 4, On the need for avoiding intemperate language in discussions on zoological nomenclature; 5, On the grant to the International Commission . . . of plenary powers to suspend the rules in certain cases. Opinion 145. On the status of names first published in works rejected for nomenclaturial purposes and subsequently published in other works; 146, Suspension of the rules for Colias Fab. (1807); 147, On the principles to be observed in interpreting Art. 34 of the Code in relation to the rejection, as homonyms, of generic and subgeneric names of the same origin and meaning as names previously published; 148, On the principles to be observed in interpreting Art. 25 & 34 of the Code in relation to the availability of generic names proposed as emendations of, or as substitutes for, earlier generic names of the same origin and meaning.

Bulletin of Zoological Nomenclature, Vol. 1 part 3, pp. 1–86.

LIST OF JOURNALS CITED

1.—Trans. Amer. Entom. Soc. 4.—Canadian Entomol. 7.—Ann. Entom. Soc. America. 9.—The Entomologist,

London. 10.—Proc. Entom. Soc. Washington. 13.—Jour. Entom. & Zool. 14.—Arch. Inst. Biol., S. Paulo. 15.—Anais Acad. Brasil, Cien., Rio. 20.—Annals of Appl. Biology. 21.—Entom. Record & Jour. Variation. 22.—Bull. Entom. Research. 23.—Physiological Zool. 31.—Nature, London. 33.—Jour. Exper. Biology. 36.—Trans. R. Entom. Soc. London. 40.—Amer. Museum Novitates. 60.—Smithsonian Miss. Coll. 75.—Annals & Mag. Nat. Hist. 81.—Iowa Sta. Coll. Jour. Science. 107.—Proc. R. Entom. Soc. London. 108.—Proc. R. Entom. Soc. London (B). 117.—Microentom., Stanford Univ. 118.—Ward's Nat. Sci. Bull.

AN OUTLINE OF GENERAL PHYSIOLOGY (SECOND EDITION). By L. V. HEILBRUNN. 748 pages, 135 figs. W. B. Saunders Co., Philadelphia & London. Dec. 1943. Price $6.00. This is a completely revised edition of a standard reference text. It contains approximately 150 pages more than the first edition and a good many additional references to insects. There are approximately 4000 references, and a large index which seems to really cover the material presented in the text (the index lists approximately 75 page references to insect data). As in the first edition, the text treats first of protoplasmic morphology, followed by the chemical and physical properties of general cells, then the general phenomena of growth, nutrition, respiration, movement, bioluminescence, effects of environmental conditions, acclimatization, irritability and tropisms, and ends with chapters on aging and cell division. All of these subjects are treated from the standpoint of general physiological phenomena, and, by and large, processes limited to one or a few phyla are omitted.

Until recently no general survey was available in insect physiology. Wigglesworth's text (1939) has admirably filled this gap. But Wigglesworth's text is limited to the insects and does not even cover the other groups of arthropods. And, fur-

ther, Wigglesworth does not discuss the techniques employed in physiological studies or the methods of their evaluation. In Dr. Heilbrunn's text, both graduate students and research entomologists may find treatments of the techniques of physiological study, their application and limitations, a resumé of phenomena general to all animals (and plants), and mention of general insect phenomena in their proper relation to the same phenomena in other animal groups. For a proper understanding of insect physiology, a background of general physiology is required. Dr. Heilbrunn's text supplies this.—A. G. R., Jr.

EXCHANGES

This column is intended only for wants and exchanges, not for advertisements of goods for sale or services rendered. Notices not exceeding three lines free to subscribers.

These notices are continued as long as our limited space will allow; the new ones are added at the end of the column, and, only when necessary those at the top (being longest in) are discontinued.

Wanted—Specimens of the genus Calendra (Sphenophorus) from North America. Will exchange Eastern U. S. Calendra or other Coleoptera for desired species. R. C. Casselberry, 302 Lincoln Avenue, Lansdowne, Penna.

Coccinellidae wanted from all parts of the world, especially South and Central America. Buy or exchange. G. H. Dieke, 1101 Argonne Drive, Baltimore, Md.

Coleoptera—Will exchange mounted and labeled specimens from North America. All groups except Rhynchophora. G. P. Mackenzie, 1284 Sherwood Road, San Marino, Calif.

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